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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>6</sup> :</b> <b>A61K 31/195</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 96/36328</b> <b>(43) International Publication Date:</b> 21 November 1996 (21.11.96)
<b>(21) International Application Number:</b> PCT/US96/05898 <b>(22) International Filing Date:</b> 26 April 1996 (26.04.96) <b>(30) Priority Data:</b> 08/440,570 15 May 1995 (15.05.95) US <b>(71) Applicant:</b> WARNER-LAMBERT COMPANY [US/US]; 201 Tabor Road, Morris Plains, NJ 07950 (US). <b>(72) Inventor:</b> PANDE, Atul, Chandra; 3355 Landings Drive, Ann Arbor, MI 48103 (US). <b>(74) Agents:</b> RYAN, M. Andrea; Warner-Lambert Company, 201 Tabor Road, Morris Plains, NJ 07950 (US) et al.		<b>(81) Designated States:</b> AU, BG, CA, CN, CZ, EE, GE, HU, JP, KR, LT, LV, MX, NO, NZ, PL, RO, SG, SI, SK, UA, UZ, Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> A METHOD OF TREATMENT OF MANIA AND BIPOLAR DISORDER  <b>(57) Abstract</b>  The present invention is a novel therapeutic use of gabapentin, its derivatives, and the pharmaceutical salts thereof. The compounds are useful in the treatment of mania in all its various forms whether acute or chronic, single or recurrent, and whether or not it is associated with depression. The invention further includes the preventative treatment of bipolar disorder.		

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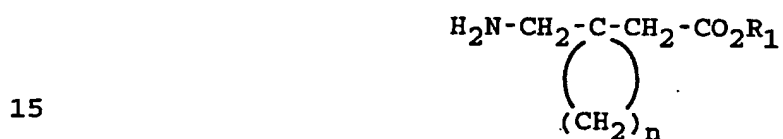
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## A METHOD OF TREATMENT OF MANIA AND BIPOLAR DISORDER

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## BACKGROUND OF THE INVENTION

10 United States Patent Numbers 4,024,175 and  
4,087,544, which are incorporated herein by  
reference, teach cyclic amino acids of formula



wherein  $\text{R}_1$  is hydrogen or lower alkyl and  $n$  is an  
integer of from 4 to 6 and the pharmaceutically  
acceptable salts thereof.

20 The compounds disclosed in the above United  
States patents are useful for the therapy of certain  
cerebral diseases, for example, they can be used for  
the treatment of certain forms of epilepsy, faintness  
attacks, hypokinesia, and cranial traumas.  
25 Additionally, they bring about an improvement of  
cerebral functions and thus are useful in treating  
geriatric patients. Particularly valuable is  
1-(aminomethyl)-cyclohexane-acetic acid (gabapentin).

30 United States Patent Number 5,084,479 teaches  
the compounds of the above formula for therapeutic  
use in neurodegenerative disorders such as  
Alzheimer's, Huntington's, Parkinson's, and  
Amyotrophic Lateral Sclerosis. It also teaches the  
use of the compounds in the treatment of acute brain  
35 injury such as stroke, head trauma, and asphyxia.

United States Patent Number 5,025,035 teaches  
the use of the compounds of the above formula for  
depression.

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United States Patent Application Serial  
Number 08/281285 teaches the use of the compounds  
of the above formula to treat anxiety and/or panic  
disorders.

5        There is no disclosure in the above references  
to make obvious the present invention of novel uses  
of the compounds of United States Patent  
Number 4,024,175 to treat mania and/or bipolar  
disorder.

10

#### SUMMARY OF THE INVENTION

15        The present invention relates to novel  
therapeutic uses of a known compound, gabapentin, its  
derivatives, and pharmaceutically acceptable salts.  
The invention concerns a method for treating the  
symptoms of mania in a human in need of such  
treatment. This method includes, but is not limited  
20        to the treatment of mania in all its various forms  
whether acute or chronic, single or recurrent  
episode, and associated with depression or not. The  
invention further includes the preventive treatment  
of bipolar disorder in persons predisposed to this  
25        disorder.

Episodes of acute mania are characterized by  
elevated or irritable mood, disturbed sleep,  
grandiosity, increased motor activity, pressured  
thinking, distractibility and poor concentration,  
30        impaired judgement, and sometimes psychotic symptoms.  
The irritability can lead to outbursts of angry or  
aggressive behavior. Often the episodes are preceded  
by a period of disturbed sleep. The distractibility  
makes the patient move endlessly from one activity to  
35        another often to the detriment of their physical,  
occupational, and social well-being. The impact of

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these behaviors is further aggravated by the lapses of judgement and poor decision-making that is characteristic of this illness.

5       Episodes of mania occur in patients who suffer  
from bipolar disorder which is an illness  
characterized by alternating cycles of depression and  
mania. This disorder is distinct from the more  
common form of depression, called Major Depressive  
Disorder, in which patients only experience recurrent  
10       episodes of depression but no mania. Bipolar  
disorder can be diagnosed by the clinical evaluation  
of patients using the criteria specified in the  
Diagnostic and Statistical Manual (DSM-IV) of the  
American Psychiatric Association. In this  
15       nomenclature system, bipolar disorder is subsumed  
under the broader class of Mood Disorders and is  
clearly distinguished from the Anxiety Disorders and  
from Organic Mental Disorders.

      In studies of epilepsy, gabapentin has been  
20       noted to reduce anger and irritability, enhance  
concentration, and improve decision-making abilities.  
These effects will be beneficial in the symptomatic  
treatment of patients suffering from mania who  
exhibit irritability, distractibility, and poor  
25       judgement. This is a novel use for gabapentin which  
would not be obvious to a medical practitioner of  
ordinary skill.

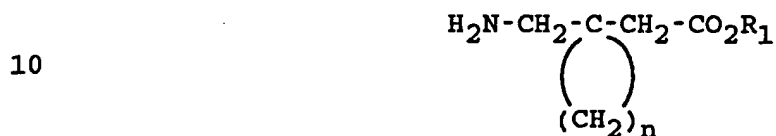
      In one study gabapentin has also been found to  
enhance delta-wave (deep) sleep. This effect will be  
30       beneficial in acute mania and will also lead to  
reducing the risk for onset of a new episode of mania  
in a predisposed individual. Thus, the prophylactic  
use of gabapentin for bipolar disorder is also  
taught.

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## DETAILED DESCRIPTION

5 The present invention relates to novel methods of treating mania and/or bipolar disorder in a mammal in need of such treatment. The treatment comprises administering in unit dosage form an effective amount of a compound of formula



wherein  $\text{R}_1$  is hydrogen or a lower alkyl and  $n$  is 4, 5, or 6 or a pharmaceutically acceptable salt thereof.  
15 The term lower alkyl includes straight or branched chain alkyl groups of up to 8 carbon atoms.

Preferred compounds of Formula I above include but are not limited to 1-aminomethyl-1-cyclohexane-acetic acid, ethyl 1-aminomethyl-1-cyclohexane-acetate, 1-aminomethyl-1-cycloheptane-acetic acid, 1-aminomethyl-1-cyclopentane-acetic acid, methyl 1-aminomethyl-1-cyclohexane-acetate, n-butyl 1-aminomethyl-1-cyclohexane-acetate, methyl 1-aminomethyl-1-cycloheptane-acetate, n-butyl 1-aminomethyl-1-cycloheptane-acetate, toluene sulfonate, 1-aminomethyl-1-cyclopentane-acetate, benzene-sulfonate, and n-butyl 1-aminomethyl-1-cyclopentane-acetate.

30 The most preferred compound is 1-aminomethyl-cyclohexane acetic acid (gabapentin).

Pharmaceutical compositions of the compound of the present invention or its salts are produced by formulating the active compound in dosage unit form with a pharmaceutical carrier. Some examples of dosage unit forms are tablets, capsules, pills, 35 powders, aqueous and nonaqueous oral solutions and

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suspensions, and parenteral solutions packaged in containers containing either one or some larger number of dosage units and capable of being subdivided into individual doses. Some examples of suitable pharmaceutical carriers, including pharmaceutical diluents, are gelatin capsules; sugars such as lactose and sucrose; starches such as corn starch and potato starch, cellulose derivatives such as sodium carboxymethyl cellulose, ethyl cellulose, methyl cellulose, and cellulose acetate phthalate; gelatin; talc; stearic acid; magnesium stearate; vegetable oils such as peanut oil, cottonseed oil, sesame oil, olive oil, corn oil, and oil of theobroma; propylene glycol, glycerin; sorbitol; polyethylene glycol; water; agar; alginic acid; isotonic saline, and phosphate buffer solutions; as well as other compatible substances normally used in pharmaceutical formulations. The compositions of the invention can also contain other components such as coloring agents, flavoring agents, and/or preservatives. These materials, if present, are usually used in relatively small amounts. The compositions can, if desired, also contain other therapeutic agents.

The percentage of the active ingredients in the foregoing compositions can be varied within wide limits, but for practical purposes it is preferably present in a concentration of at least 10% in a solid composition and at least 2% in a primary liquid composition. The most satisfactory compositions are those in which a much higher proportion of the active ingredient is present.

Routes of administration of the subject compound or its salts are oral or parenteral. For example, a useful intravenous dose is between 5 and 50 mg and a useful oral dosage is between 20 and 200 mg. The

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dosage is within the dosing range used in epilepsy treatment or as would be with the needs of the patient as described by the physician.

5 A unit dosage form of the instant invention may also comprise other compounds useful in the therapy of neurodegenerative diseases.

10 The advantages of using the compounds of Formula I, especially gabapentin, in the instant invention include the relatively nontoxic nature of the compound, the ease of preparation, the fact that the compound is well-tolerated, and the ease of IV administration of the drug. Further, the drug is not metabolized in the body.

15 The subjects as used herein are mammals, including humans.

20 The usefulness of compounds of Formula I above and the salts thereof as agents for mania in all its various forms and in the preventative treatment of bipolar disorder is demonstrated in its effects on the mental functions of patients. These effects were observed during epilepsy clinical trial. See Table 1 below wherein the effects beneficial to patients with bipolar disorder are presented.

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TABLE 1

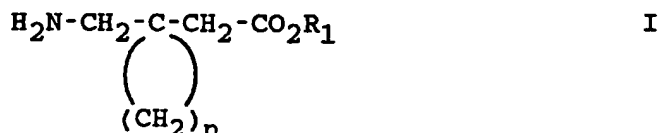
Patient No.	Effect
1	More relaxed
2	More socially responsive, better concentration
5	3 More sharp cognitively, more relaxed. Decreased confusion, increased comprehension
4	Less nervous energy, more serene
5	More relaxed
6	Less insomnia
7	Thinking is clearer
10	8 Psychic improvement, more present, more relaxed
9	Able to think more clearly
10	More clear than before
11	More relaxed
12	More relaxed and somehow better
15	13 Feels better, has not been so impulsive
14	Alertness and speech have improved
15	More alert and able to concentrate better
16	More clear headed, memory has improved

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## CLAIMS

1. A method for treating the symptoms of mania in a mammal in need of said treatment which comprises administering a therapeutically effective amount of a compound of formula

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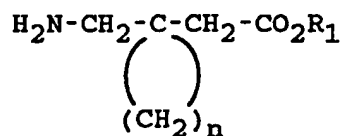
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or a pharmaceutically acceptable salt thereof wherein  $\text{R}_1$  is hydrogen or lower alkyl and  $n$  is an integer of from 4 to 6 in unit dosage form.

2. A method according to Claim 1 wherein the mania is acute.
3. A method according to Claim 1 wherein the mania is chronic.
4. A method according to Claim 1 wherein the mania is a single episode.
5. A method according to Claim 1 wherein the mania is recurring.
6. A method according to Claim 1 wherein gabapentin is administered.
7. A method for treating and/or preventing bipolar disorder in a mammal in need of said treatment which comprises administering a therapeutically effective amount of a compound of formula

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or a pharmaceutically acceptable salt thereof  
wherein  $\text{R}_1$  is hydrogen or lower alkyl and  $n$  is an  
integer of from 4 to 6 in unit dosage form.

8. A method according to Claim 7 wherein the compound  
administered is gabapentin.

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 96/05898

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 A61K31/195

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,4 024 175 (SATZINGER GERHARD ET AL) 17 May 1977 cited in the application ---	1-8
A	EP,A,0 446 570 (WARNER LAMBERT CO) 18 September 1991 cited in the application ---	1-8
A	US,A,5 025 035 (WALLACE JAN D) 18 June 1991 cited in the application ---	1-8
A	WO,A,91 19493 (US ARMY) 26 December 1991 see claim 2 ---	1-8
A	US,A,4 355 044 (HELLER BERNARDO) 19 October 1982 -----	1-8

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

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- "E" earlier document but published on or after the international filing date
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Date of the actual completion of the international search

24 July 1996

Date of mailing of the international search report

- 2. 08. 96

Name and mailing address of the ISA

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Authorized officer

De Jong, B

# INTERNATIONAL SEARCH REPORT

I International application No.

PCT/US 96/05898

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:  
Although claims 1-8 are directed to a method of treatment of (diagnostic method practised on) the human/animal body, the search has been carried out and based on the alleged effects of the compound/composition.
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

International Application No.  
PCT/US 96/05898

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